UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/740,901	12/21/2000	Makoto Kidera	200901US2	6368

22850	7590	11/24/2004

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EXAMINER
HOGAN, MARY C

ART UNIT	PAPER NUMBER
2123	

DATE MAILED: 11/24/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

	Application No.	Applicant(s)	
Office Action Summary	09/740,901	KIDERA ET AL.	
	Examiner	Art Unit	
	Mary C Hogan	2123	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE <u>3</u> MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.
- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
  Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) ☒ Responsive to communication(s) filed on <u>23 September 2004</u>.

2a) ☒ This action is **FINAL**.   2b) ☐ This action is non-final.

3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4) ☒ Claim(s) <u>1-11</u> is/are pending in the application.

    4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5) ☐ Claim(s) _____ is/are allowed.

6) ☒ Claim(s) <u>1-11</u> is/are rejected.

7) ☐ Claim(s) _____ is/are objected to.

8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9) ☐ The specification is objected to by the Examiner.

10) ☒ The drawing(s) filed on <u>23 September 2004</u> is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.

    Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

    Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

    a) ☒ All   b) ☐ Some *   c) ☐ None of:

      1. ☒ Certified copies of the priority documents have been received.

      2. ☐ Certified copies of the priority documents have been received in Application No. _____.

      3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

    * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other: _____.

DETAILED ACTION

1.   This application has been examined.

2.   **Claims 1-11** have been examined and rejected.

3.   Objections/Rejections contained in the first Office Action that are not repeated in the following Office Action are hereby withdrawn.

Claim Rejections - 35 USC § 112

4.   The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

5.   **Claims 5 and 8-11** are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

6.   **Claim 5** recites "variations in said first and second electrical characteristics calculated in step (d)". However, "step (d)" is defined in claim 1 as "determining variations in said device parameter at said at least one corner" wherein determining the variations in electrical characteristics is taught as step (e) in claim 3. This makes the claim vague and indefinite since it is unclear what step the claim is directed to.

7.   **Claims 8 and 10** recite all the limitations of Claim 1 in the preamble of the claims. Therefore, it is unclear as to whether the applicant is attempting to recite the preamble as limitations to the claimed invention or as prior art.

Claim Interpretation

8.   **Claim 1** recites the term "forming" and there is no clarification in the claim language or the specification how the corner model is "formed". Therefore, it was interpreted that "forming" the corner model was directed to the use of a corner model determined from prior knowledge of process parameters, electrical characteristics and process conditions.

9.   **Claim 5** recites "variations in said first and second electrical characteristics calculated in step (d)". However, "step (d)" is defined in claim 1 as "determining variations in said device parameter at said at least one corner" wherein determining the variations in electrical characteristics is taught as step (e) in claim 3. It was determined that the claim was mean to read "variations in said first and second electrical characteristics calculated in step (e).

Claim Rejections - 35 USC § 103

10.   The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness
rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as
> set forth in section 102 of this title, if the differences between the subject matter sought to be
> patented and the prior art are such that the subject matter as a whole would have been obvious at
> the time the invention was made to a person having ordinary skill in the art to which said subject
> matter pertains. Patentability shall not be negatived by the manner in which the invention was
> made.

11.   The factual inquiries set forth in *Graham* v. *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966),
that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are
summarized as follows:

1.   Determining the scope and contents of the prior art.
2.   Ascertaining the differences between the prior art and the claims at issue.
3.   Resolving the level of ordinary skill in the pertinent art.
4.   Considering objective evidence present in the application indicating obviousness or
      nonobviousness.

12.   **Claims 1-11** are rejected under 35 U.S.C. 103(a) as being unpatentable over Kunikiyo (U.S.
Patent Number 5,845,105), herein referred to as **Kunikiyo**, and further in view of Applicant's Own
Admission (Figures 9-11, specification pages 2-6), herein referred to as **AOA**.

13.   As to **Claim 1, Kunikiyo** teaches: A method of simulating variations in first and second electrical
characteristics of a semiconductor integrated circuit the method comprising: b) assigning said variations
in said first and second electrical characteristics at said at least one corner as respective predetermined
values **(column 7, lines 49-53 and equation 2)**; c) performing a circuit simulation to determine
respective device parameter sensitivities of said first and second electrical characteristics at said at least
one corner, the device parameter sensitivities representing respective derivatives of said first and second
electrical characteristics with respect to a device parameter **(equations 2, 3 and 7 wherein "S" is
representative of the electrical characteristics)**; and d) applying said device parameter sensitivities and
said predetermined value to the normal equation of the least squares method, and solving the normal

equation to determine variations in said device parameter at said at least one corner **(columns 9 and 10, equations 9-15 and description)**.

14.   **Kunikiyo** teaches finding the differences between the values of the electrical characteristics represented by the process functions thus determined and the values in the specification **(column 6, lines 36-49, equation 1, column 7, lines 49-53, equation 2)**. From this explanation, it is understood that this method determines variations of said first and second electrical characteristics between a specified value and a value at a certain process condition or "corner". However, **Kunikiyo** does not expressly teach forming a corner model.

15.   **AOA** teaches "a model generally known as a corner model" **(page 2, line 11)** wherein the corners define the limits of the variations of electrical characteristics at certain process conditions **(Figure 9, BB, AA, BA, AB)** and provide the range of variations in the device parameters relative to the center of the quadrilateral **(page 3, lines 21-24)**. Further, **AOA** states that the variations in the electrical characteristics are expressed as the quadrilateral **(page 5, lines 8-10)** and that, "conventionally", these variations are fed into a simulator and are used to calculate electrical characteristic values that correspond to the device parameter set **(page 6, lines 3-16)**.

16.   It would have been obvious to one of ordinary skill in the art to modify the calculations of variations in a first and second electrical characteristics as taught in **Kunikiyo** to include a corner model as taught by **AOA** since **AOA** teaches the corner model as a "generally known" method to represent the variations in electrical characteristics and defining limits of variations at certain process conditions. Further, since **Kunikiyo** teaches determining the differences between values of the electrical characteristics represented by the process functions thus determined (at a process condition or "corner") and the specified value, it is determined that the method in **Kunikiyo** is expressly teaching a method that is functionally equivalent to the method used in **AOA**.

17.   As to **Claim 2, Kunikiyo** teaches: wherein said device parameter includes at least one of a model parameter regarding the shape of said semiconductor integrated circuit (example t_{ox}, W_s) **(column 6, lines 45-48)** and a process parameter regarding a condition during the steps of manufacturing said semiconductor integrated circuit. **(column 6, lines 36-38, Figure 11)**.

18.   As to **Claim 3, Kunikiyo** teaches: (e) calculating the variations in said first and second electrical characteristics at said at least one corner, based on a multiplication of said device parameter sensitivities provided in said step (c) and the variations in said device parameter at said at least one corner provided in said step (d) **(equations 7 and 16 and column 13, lines 25-27)**.

19.   As to **Claim 4, Kunikiyo** teaches: wherein a comparison is made between the variations in said first and second electrical characteristics calculated in said step (e) and said predetermined value values prepared in said step (b), and if a difference between said variations and said predetermined values of said first and second electrical characteristics is greater than a prescribed value, said steps (c) through (e) are executed again **(column 9, lines 34-40, Figure 13, steps 44-60)**.

20.   As to **Claim 5, Kunikiyo** teaches: wherein a comparison is made between the variations in said first and second electrical characteristics calculated in said step (d) and said predetermined values prepared in step (b), and if a difference between said variations and said predetermined values of said first and second electrical characteristics is greater than a prescribed value, said steps (c) through (e) are repeated using a new device parameter and said device parameter in combination **(column 9, lines 34-40, Figure 13, steps 44-60, equation 17, column 11, lines 27-33)**.

21.   As to **Claim 6, Kunikiyo** teaches: wherein said device parameter includes a plurality of device parameters, and wherein said step (d) is not executed upon at least one of said device parameters, but is instead executed upon only a remainder of said plurality of device parameters **(equation 17, column 11, lines 12-15, 27-38)**.

22.   As to **Claim 7, Kunikiyo** teaches: wherein said variations in said device parameters are determined using the weighted least squares method **(equations 9 and 12, column 10, lines 59-61, equations 16 and 17)**.

23.   As to **Claims 8 and 10, Kunikiyo** teaches: a device for simulating variations in first and second electrical characteristics of a semiconductor integrated circuit by (a) forming a corner model including at least one corner defining predetermined limits of said variations of said first and second electrical characteristics (b) assigning said variations in said first and second electrical characteristics at said at least one corner, as respective predetermined values, (c) performing a circuit simulation to determine respective device parameter sensitivities of said first and second electrical characteristics at said at said at least one corner, the respective device parameter sensitivities representing respective derivatives of said first and second electrical characteristics with respect to a device parameter, and (d) applying said device parameter sensitivities and said predetermined values to the normal equation of the least squares method, and solving the normal equation to determine variations in said device parameter at said at least one corner **(see reasons for Claim 1)**, said device comprising:

        a data input unit configured to input said predetermined values **(Figure 14, element 72 and Figure 13, elements 40 and 42)**;

a simulator configured to simulate the variations in said first and second electrical characteristics, when said device parameter is changed, in order to determine said device parameter sensitivities **(Figure 13)**; and

a data processing unit (means) configured to apply said device parameter sensitivities determined by said simulator and said predetermined values inputted to said data input unit to the normal equation of the least squares method, to determine variations in said device parameter at said at least one corner, the and to output the variations in said device parameter at said at least one corner **(Figure 14, element 72 and Figure 13)**.

24.   As to **Claims 9 and 11, Kunikiyo** teaches: further comprising a data storage section configured to store data about said device parameter sensitivities and data about said variations in said device parameter **(Figure 14, element 72 "memory")**.

Response to Arguments

25.   Applicants arguments filed on 9/23/04 regarding Claims 1-11 have been considered but they are not persuasive.

26.   Applicant argues that Kunikiyo does not teach the corner model (page 12, paragraph 3).

27.   As to the above argument, further examination has determined that although Kunikiyo does not expressly teach a corner model, he teaches an equivalent method. Further, Applicant admits that the corner model is known in the art (see reasons for claim 1 for further clarification).

28.   Applicant argues "Applicants respectfully note that, assuming arguendo, Kunikiyo's Figure 10 is enabling, it would only be enabling based on a hindsight application of the teachings of Applicants' invention, whereby the noted Figure 10 conceivably could be interpreted to derive Applicants' invention" (page 12, paragraph 4).

29.   In response to applicant's argument that the examiner's conclusion of obviousness is based upon improper hindsight reasoning, it must be recognized that any judgment on obviousness is in a sense necessarily a reconstruction based upon hindsight reasoning. But so long as it takes into account only knowledge which was within the level of ordinary skill at the time the claimed invention was made, and does not include knowledge gleaned only from the applicant's disclosure, such a reconstruction is proper. See *In re McLaughlin*, 443 F.2d 1392, 170 USPQ 209 (CCPA 1971).

30.   Applicant argues, "The claimed device parameter sensitivities represent respective derivatives of the first and second electrical characteristics, with respect to a device parameter. On the other hand, Equation 13 of Kunikiyo represents a derivative of a sum of squares formula S incorporating all electrical

characteristics. As Equation 13 does not treat each electrical characteristic separately (i.e., respectively) with respect to a device parameter, Equation 13 does not teach the claimed device parameter sensitivities" (page 13, paragraph 3).

31.   As to the above argument, it is noted "respective" is defined as "relating to two or more things regarded individually" (The American Heritage College Dictionary). From this definition, it is unclear to the examiner that the claim is directed to treating each electrical characteristic separately with respect to a device parameter. Equations 2, 3 and 7 include "S" in the numerator which is the weighted sums of squares of the electrical parameters. Therefore, the derivative of "S" is a respective derivative of the electrical characteristics since it relates two or more things regarded individually (for example, V_{th}, G_m, BV and K) by adding together the sums of squares.

32.   Applicant argues (a) the claimed invention determines a parameter set at a corner of a corner model, while Kunikiyo determines a parameter set represented in the form of a response surface (b) the claimed invention determines a parameter set from a normal equation based on a circuit simulation. Kunikiyo determines a parameter set from a multinomial equation based on a characteristic of a response surface (c) the claimed invention utilizes device parameter sensitivities that allow a linear assumption of a variation of those sensitivities. Kunikiyo teaches only the determination of an optimum value.

33.   As to (a) Kunikiyo determines a parameter set using a method functionally equivalent to a corner model (see reasons for claim 1 for further clarification).

34.   As to (b) Kunikiyo determines a parameter set from a normal equation based on circuit simulation (columns 9 and 10, equations 9-15 and description), where x is the parameter set.

35.   As to (c) Kunikiyo teaches a linear assumption of a variation of device sensitivities (see Figures 21 and 22 and description).

Conclusion

36.   The prior art made of record, see PTO 892, and not relied upon is considered pertinent to applicant's disclosure, careful consideration must be given prior to Applicant's response to this Office Action.

37.   Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing
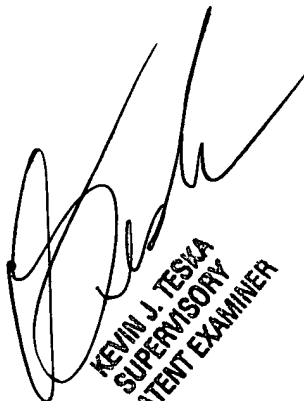
date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

38.   Any inquiry concerning this communication or earlier communications from the examiner should be directed to Mary C Hogan whose telephone number is 571-272-3712. The examiner can normally be reached on 7:30AM-5PM Monday-Friday. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kevin Teska can be reached on 571-272-3716. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Mary C Hogan
Examiner
Art Unit 2123

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